

PRELIMINARY DATA SUMMARY

November 1991

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Measurements and Analysis work units at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height of 7.6 m above the National Geodetic Vertical Datum (NGVD). In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Michael W. Leffler at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

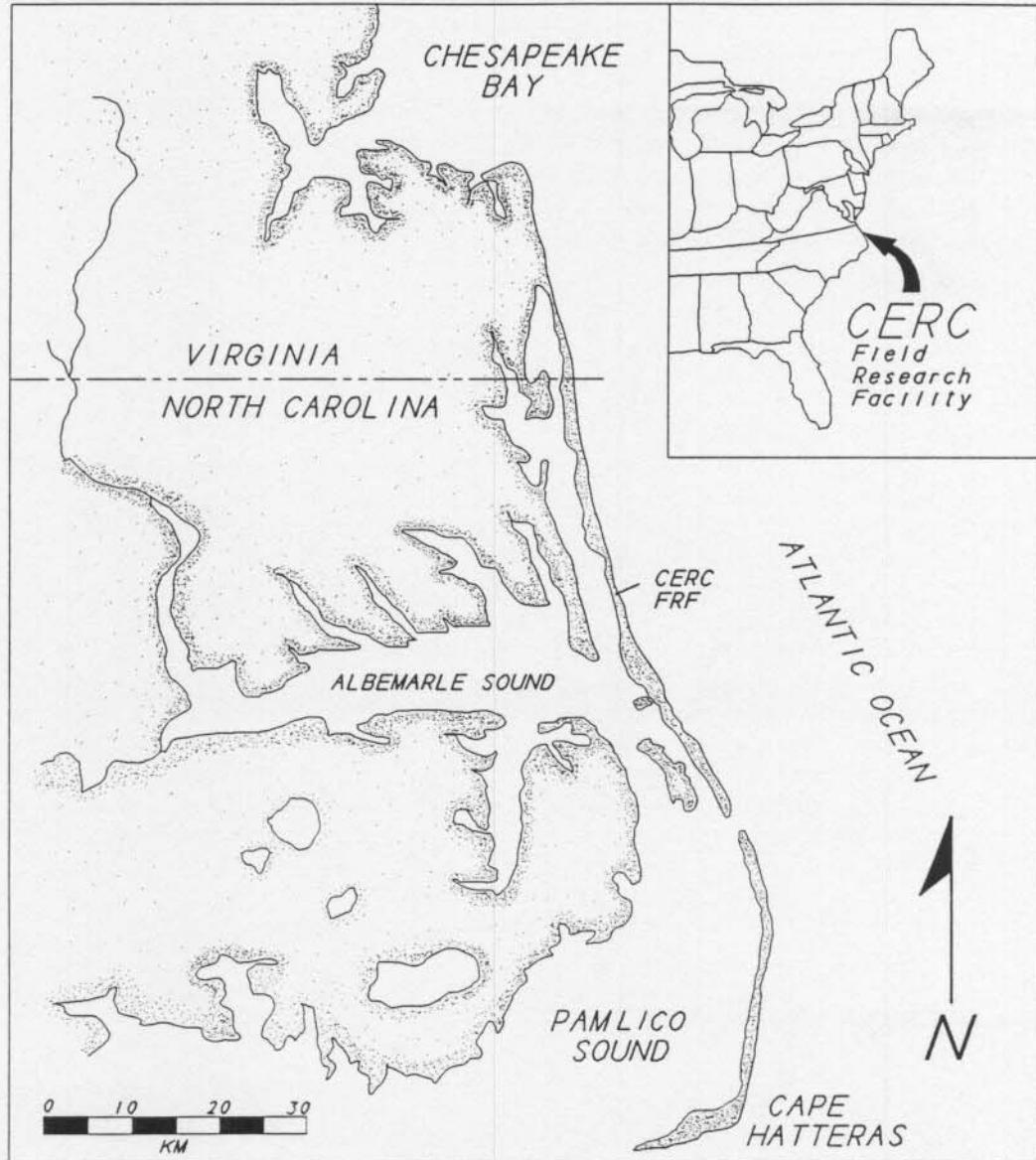


Figure 1. FRF Location Map

Table 1: Instrument Status/Data Availability

NOV 1991

Gage ID	Description/Remarks	Depth at Sensor		Day of the month																															
				1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0		
616	Barometric Pressure		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Analog Record	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
604	Precipitation		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
624	Air Temperature		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
932	Anemometer at seaward end of pier Elevation 19 m (NGVD)		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
645	Baylor staff at station 7+80 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
625	Baylor staff at station 18+60 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
630	Waverider buoy 6.0 km offshore	Approx. 23 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
519	Current meter 320 m north of FRF pier (0.9 km offshore)	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	/	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Supplemental Observations (daily oceanographic and meteorological observations)		Daily observation	/	*	*	/	*	/	/	/	/	/	/	*	*	/	*	*	/	*	*	/	*	*	*	*	*	*	*	*	*	*		

Gage Status	Daily Observation	Analog Record	Data Collected
Operational = *	Complete = *	Complete = *	All = *
Partial = /	Partial = /	Partial = /	Partial = /
Non-Operational = -	None = -	None = -	None = -

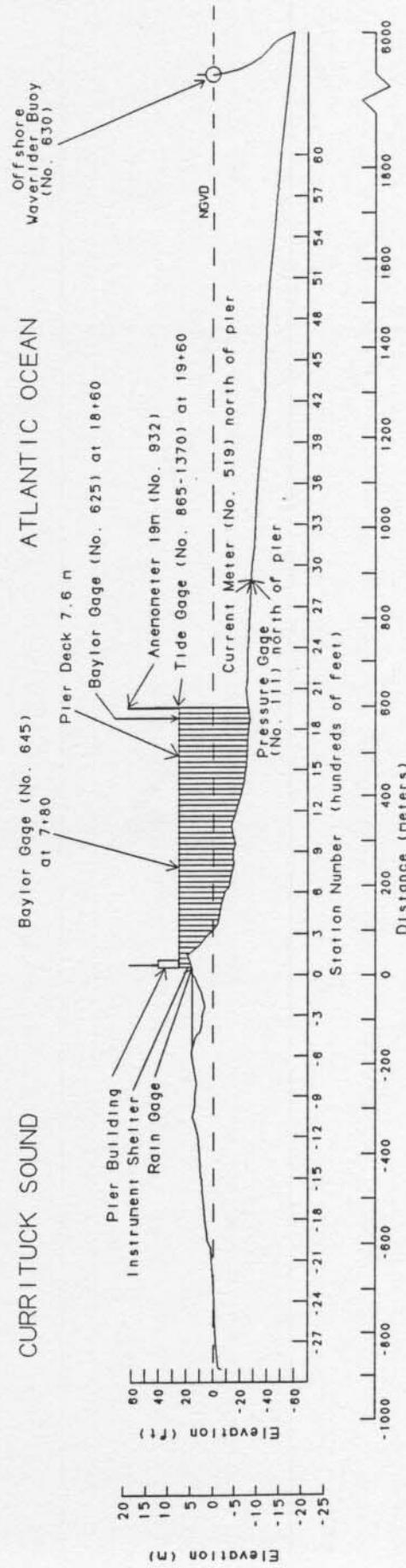
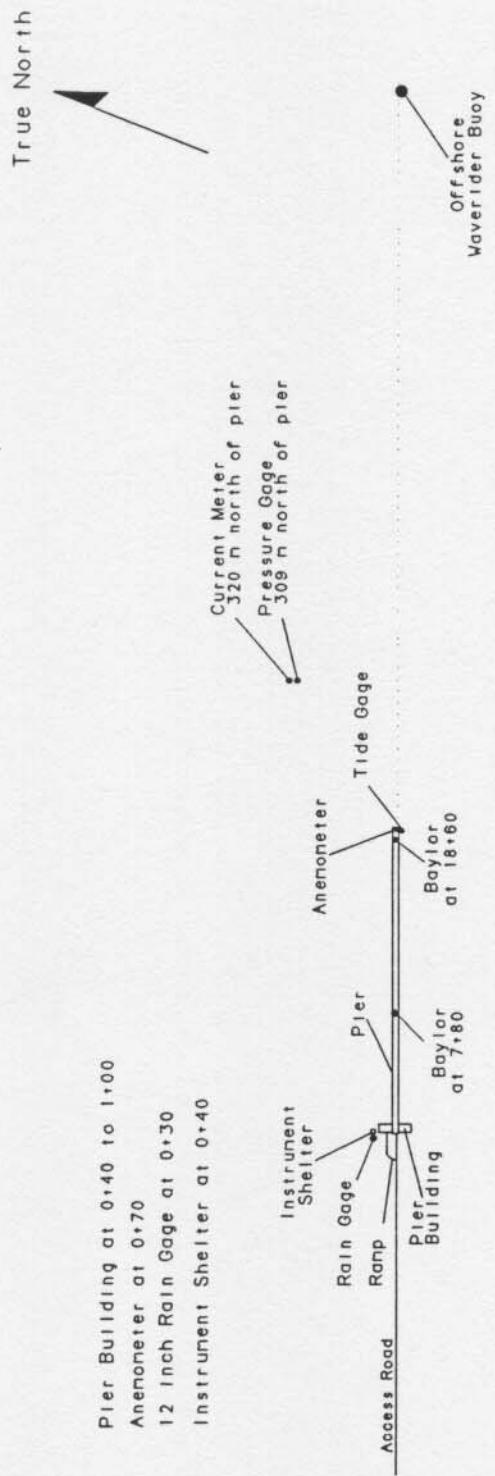


Figure 2. Instrument locations at FRF (all elevations from NGVD, all distances from FRF baseline).

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured at the end of the pier at an elevation of 19 m (Figure 2) using a Weather Measure Skyvane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Temperature and atmospheric pressure means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $mm \times .03937 = in.$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $mb \times 0.02953 = in. Hg$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

Table 2: Meteorological Data

Nov 1991

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
1	100	5	309	16.7	1013.1	0
	700	5	308	16.6	1014.2	0
	1300	2	302	18.4	1013.8	0
	1900	4	158	18.5	1013.8	0
2	100	6	178	20.0	1013.5	0
	700	8	189	22.8	1013.5	0
	1300	5	225	26.2	1012.5	0
	1900	7	198	23.7	1014.2	0
3	100	6	292	20.2	1015.9	0
	700	7	4	18.9	1019.2	0
	1300	5	350	17.9	1020.3	0
	1900	3	93	18.3	1020.3	0
4	100	5	41	18.7	1018.9	0
	700	6	48	18.4	1018.2	0
	1300	14	358	17.4	1017.9	0
	1900	12	1	15.0	1020.9	0
5	100	10	3	15.0	1021.3	0
	700	10	1	14.3	1023.3	0
	1300	9	345	13.8	1023.0	0
	1900	5	322	12.9	1022.3	0
6	100	5	312	12.5	1021.9	0
	700	5	316	13.3	1021.6	0
	1300	4	29	16.9	1020.9	0
	1900	4	86	16.5	1019.2	2
7	100	6	16	17.0	1017.9	0
	700	6	19	18.3	1017.2	0
	1300	10	350	18.5	1015.5	0
	1900	9	21	18.6	1016.2	0
8	100	13	9	17.8	1015.5	0
	700	16	11	16.4	1016.2	0
	1300	16	355	16.4	1017.2	0
	1900	16	2	16.3	1019.2	0
9	100	17	9	16.2	1018.6	0
	700	17	33	18.0	1017.2	19
	1300	20	26	18.4	1014.2	0
	1900	19	37	19.1	1012.5	4
10	100	17	44	20.6	1007.0	0
	700		Power Failure			16
	1300	4	137	20.3	1003.7	0
	1900	8	249	19.4	1004.7	0
11	100	8	257	16.2	1005.0	0
	700	10	262	14.2	1007.4	0
	1300	9	280	15.0	1008.4	0
	1900	5	278	15.1	1012.8	0
12	100	10	331	14.0	1015.9	0
	700	6	312	13.2	1017.9	0
	1300	3	330	16.2	1016.9	0
	1900	2	264	15.0	1016.5	0
13	100	1	219	15.1	1014.8	0
	700	10	355	15.1	1016.5	0
	1300	7	6	16.3	1017.2	0
	1900	2	196	14.1	1018.2	0
14	100	4	225	15.0	1017.5	0
	700	6	248	15.3	1018.9	0
	1300	2	27	18.3	1019.2	0
	1900	2	157	16.1	1020.9	0
15	100	3	222	16.5	1021.9	0
	700	3	176	16.8	1021.9	0
	1300	5	191	22.0	1019.2	0
	1900	7	199	18.0	1017.9	0
16	100	5	234	18.1	1016.9	0
	700	5	244	18.1	1016.2	0
	1300	4	249	21.6	1014.2	0
	1900	0		18.2	1015.5	0

* electronic problems

(Continued)

Table 2: Meteorological Data

Nov 1991

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
17	100	14	7	17.5	1018.9	0
	700	12	20	15.7	1023.6	0
	1300	8	22	15.9	1024.7	0
	1900	5	23	15.2	1025.3	0
18	100	4	324	14.0	1025.0	0
	700	3	338	14.3	1024.7	0
	1300	3	9	17.3	1024.3	0
	1900	3	142	16.5	1024.3	0
19	100	3	188	16.3	1024.0	0
	700	5	159	18.1	1025.0	0
	1300	6	231	22.6	1024.0	0
	1900	6	187	20.8	1024.3	0
20	100	6	195	18.8	1024.0	0
	700	6	205	19.6	1023.0	0
	1300	8	211	24.6	1020.9	0
	1900	7	193	21.6	1020.9	0
21	100	6	200	21.4	1019.9	0
	700	6	194	22.0	1019.6	0
	1300	6	230	24.6	1017.2	0
	1900	6	195	22.9	1017.9	0
22	100	7	194	22.5	1017.2	0
	700	10	186	23.0	1016.5	0
	1300	14	169	25.5	1008.4	0
	1900	10	182	25.3	1005.4	0
23	100	7	222	21.2	1006.4	0
	700	5	239	19.6	1009.8	0
	1300	3	207	22.3	1014.5	0
	1900	7	185	20.4	1013.5	0
24	100	6	193	22.3	1009.8	0
	700	5	215	22.2	1008.4	5
	1300	10	258	21.4	1005.7	0
	1900	9	280	18.4	1010.4	0
25	100	10	290	13.8	1014.2	0
	700	7	292	12.5	1017.5	0
	1300	5	274	14.7	1017.2	0
	1900	5	311	13.7	1019.2	0
26	100	6	326	12.5	1020.6	0
	700	7	6	12.7	1023.6	0
	1300	6	352	6.7	1025.0	0
	1900	6	325	3.8	1028.4	0
27	100	5	28	5.9	1029.1	0
	700	6	63	7.0	1030.1	0
	1300	7	22	9.7	1028.4	0
	1900	4	353	8.4	1028.4	0
28	100	3	307	7.0	1027.7	0
	700	2	299	5.7	1028.4	0
	1300	2	220	13.4	1026.3	0
	1900	6	193	10.3	1025.7	0
29	100	6	223	9.6	1024.7	0
	700	5	230	9.5	1025.3	0
	1300	4	224	17.4	1023.6	0
	1900	6	197	15.2	1024.0	0
30	100	6	198	14.7	1023.6	0
	700	2	186	14.7	1025.0	0
	1300	6	197	22.3	1022.6	0
	1900	5	198	17.3	1021.9	0
<u>Resultant</u>			<u>Mean</u>	<u>Mean</u>	<u>Total</u>	
2			318	16.9	1018.4	46

* electronic problems

(Sheet 2 of 2)

PART III: WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hr (more frequently during storms) beginning at 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for four contiguous 34-min records.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

Table 3: Wave Data

Nov 1991

Day	Hour	645		625		111		630	
		Baylor at 7+80	Hmo.m T.sec	Baylor at 18+60	Hmo.m T.sec	Pressure Gage	Hmo.m T.sec	Offshrd Wvrdr	Hmo.m T.sec
1	0100	1.83	15.06	2.87	15.06	3.05	14.22	2.65	15.06
	0700	1.54	16.00	2.11	14.22	2.20	15.06	1.83	14.22
	1300	1.29	14.22	1.64	14.22	1.61	14.22	1.45	14.22
	1900	1.10	13.47	1.22	12.80	1.40	12.80	1.22	12.19
2	0100	0.97	11.64	1.23	11.64	1.32	11.64	1.24	12.19
	0700	0.88	12.80	1.08	12.80	1.03	11.64	1.00	12.19
	1300	0.62	11.64	0.86	12.19	0.83	12.19	0.81	11.64
	1900	0.66	11.13	0.88	11.13	0.86	11.13	0.94	11.64
3	0100	0.62	10.67	0.71	10.24	0.74	9.85	0.88	11.13
	0700	0.81	4.20	0.84	11.64	0.78	11.64	0.82	11.13
	1300	0.59	4.92	0.81	5.12	0.81	10.24	0.96	5.12
	1900	0.87	5.69	0.77	5.22	0.81	5.69	0.94	5.57
4	0100	0.44	5.33	0.71	5.45	0.70	5.33	0.82	5.22
	0700	0.69	4.20	0.79	3.88	0.75	3.71	0.85	4.00
	1300	0.64	5.02	1.14	4.41	1.17	4.57	1.75	5.02
	1900	1.44	6.40	1.70	6.56	1.73	6.92	2.14	6.56
5	0100	0.78	6.56	1.37	6.92	1.37	6.74	1.53	6.40
	0700	1.19	6.40	1.35	6.24	1.33	6.09	1.59	6.56
	1300	0.61	6.24	1.25	6.09	1.21	6.09	1.38	6.09
	1900	0.93	5.57	1.00	6.24	0.96	5.82	1.05	5.57
6	0100	0.41	4.66	0.83	8.26	0.88	8.53	0.94	5.33
	0700	0.55	4.83	0.75	8.26	0.66	8.00	0.83	8.00
	1300	0.33	18.29	0.67	7.31	0.69	7.76	0.68	7.76
	1900	0.58	8.26	0.72	8.00	0.67	8.00	0.74	8.26
7	0100	0.33	17.07	0.73	7.76	0.69	8.00	0.77	7.76
	0700	0.56	17.07	0.78	16.00	0.69	3.71	0.83	7.31
	1300	0.39	15.06	0.85	6.74	0.83	6.74	0.87	6.92
	1900	0.99	4.13	1.10	6.40	1.05	4.27	1.10	7.11
8	0100	0.74	5.02	1.33	5.02	1.36	5.12	1.51	5.02
	0700	1.48	5.95	2.06	6.74	2.11	6.09	2.66	6.56
	1300	1.14	7.31	2.09	6.92	2.38	7.11	2.40	7.11
	1900	1.38	7.31	2.60	7.76	2.71	7.76	3.08	7.53
9	0100	1.35	10.24	2.76	9.85	2.95	8.83	2.84	7.31
	0700	1.50	8.83	3.03	8.53	3.69	9.48	3.80	8.26
	1300	1.46	9.14	2.98	8.53	3.89	9.48	4.30	9.14
	1900	1.51	9.14	3.32	11.13	4.24	9.85	4.59	9.85
10	0100	1.52	11.13	3.09	12.19	4.20	10.67	4.31	11.64
	0700	Power Failure						*	
11	1300	1.64	11.64	2.48	11.64	2.59	12.19		
	1900	1.69	9.85	1.81	11.64	1.91	11.13	2.18	10.67
	0100	1.34	9.14	1.34	9.85	1.41	9.14	1.46	9.48
	0700	0.83	9.48	0.90	10.24	0.93	10.24	1.27	9.48
12	1300	0.77	9.85	0.82	9.85	0.81	9.48	1.08	9.85
	1900	0.79	9.14	0.77	9.48	0.82	9.14	1.01	8.53
	0100	1.10	5.69	0.93	8.53	0.98	3.82	1.24	8.26
	0700	1.07	6.24	0.92	5.95	0.91	6.24	1.18	5.69
13	1300	1.18	6.40	0.96	6.56	0.92	6.56	1.10	6.40
	1900	0.57	6.24	0.80	6.09	0.78	5.69	0.92	5.82
	0100	0.77	5.95	0.70	6.74	0.74	6.92	0.80	6.74
	0700	0.47	5.02	0.69	5.69	0.65	6.24	0.74	6.09
14	1300	1.20	5.45	0.95	5.57	0.92	5.45	1.37	5.22
	1900	0.42	5.95	0.64	5.69	0.70	5.95	0.84	5.69
	0100	0.56	5.33	0.45	5.22	0.44	5.33	0.51	5.22
	0700	0.11	11.13	0.31	10.67	0.33	10.24	0.39	8.26
15	1300	0.29	10.24	0.34	10.67	0.31	10.67	0.35	10.67
	1900	0.12	9.85	0.32	9.85	0.33	10.24	0.35	9.85
	0100	0.35	5.57	0.32	9.48	0.32	5.82	0.34	5.69
	0700	0.14	5.22	0.30	9.85	0.33	9.85	0.34	9.14
16	1300	0.28	8.83	0.28	9.48	0.27	9.14	0.30	9.48
	1900	0.16	19.69	0.30	9.14	0.29	9.14	0.38	3.12
	0100	0.27	18.29	0.25	18.29	0.28	18.29	0.38	18.29
	0700	0.12	18.29	0.26	17.07	0.28	17.07	0.38	17.07
	1300	0.25	17.07	0.27	16.00	0.28	17.07	0.33	17.07
	1900	0.12	17.07	0.29	17.07	0.32	17.07	0.35	16.00

* Electronic problems

(Continued)

(Sheet 1 of 2)

Table 3: Wave Data

Nov 1991

Day	Hour	645		625		111		630	
		Baylor at 7+80	Hmo.m T.sec	Baylor at 18+60	Hmo.m T.sec	Pressure Gage	Hmo.m T.sec	Offshr Wvrdr	Hmo.m T.sec
17	0100	1.16	3.88	1.11	4.00	1.03	4.20	1.12	4.13
	0700	1.38	6.24	1.74	6.74	1.88	6.24	2.09	6.56
	1300	1.47	8.53	1.66	7.31	1.68	8.26	1.80	8.00
	1900	0.90	6.24	1.14	7.11	1.13	6.92	1.26	6.56
18	0100	1.01	5.95	0.97	8.26	1.08	8.26	1.15	6.09
	0700	0.76	6.74	0.89	9.48	0.92	7.31	1.04	7.53
	1300	0.61	5.22	0.92	9.85	0.94	10.24	1.01	10.24
	1900	0.47	6.56	0.75	9.48	0.82	10.24	0.87	10.24
19	0100	0.45	9.85	0.69	9.48	0.78	9.48	0.79	9.85
	0700	0.51	9.85	0.67	9.85	0.75	9.48	0.68	9.85
	1300	0.24	9.14	0.64	9.85	0.71	9.48	0.61	9.48
	1900	0.21	9.48	0.48	9.48	0.54	8.53	0.53	8.53
20	0100	0.17	8.83	0.45	8.53	0.47	8.83	0.49	8.53
	0700	0.34	11.64	0.41	8.53	0.44	10.67	0.46	9.85
	1300	0.24	8.26	0.34	11.64	0.40	9.85	0.47	8.83
	1900	0.31	4.74	0.40	15.06	0.44	14.22	0.56	5.33
21	0100	0.28	5.12	0.36	14.22	0.39	13.47	0.55	14.22
	0700	0.49	5.33	0.46	13.47	0.45	5.33	0.63	5.57
	1300	0.34	6.92	0.35	13.47	0.41	13.47	0.55	6.09
	1900	0.50	5.22	0.45	6.09	0.45	5.02	0.61	5.95
22	0100	0.40	7.11	0.39	13.47	0.47	6.09	0.61	6.09
	0700	0.60	5.95	0.54	6.40	0.52	6.09	0.75	5.45
	1300	0.61	3.94	0.70	3.46	0.75	3.28	1.02	6.92
	1900	0.81	7.11	0.69	6.74	0.77	6.74	1.11	7.31
23	0100	0.48	7.76	0.58	7.76	0.70	8.26	0.92	7.11
	0700	0.64	7.53	0.62	8.00	0.70	7.31	0.88	7.11
	1300	0.36	8.26	0.56	8.26	0.61	8.53	0.80	8.53
	1900	0.66	7.11	0.55	7.53	0.57	7.76	0.84	6.74
24	0100	0.32	7.31	0.55	8.53	0.55	8.26	0.75	7.31
	0700	0.81	6.40	0.77	6.92	0.85	6.09	1.17	6.74
	1300	0.25	8.53	0.56	8.26	0.65	8.53	0.88	7.76
	1900	0.55	8.83	0.54	8.83	0.57	9.14	0.85	9.48
25	0100	0.26	3.51	0.64	9.48	0.55	8.83	0.92	9.48
	0700	0.81	5.02	0.70	5.12	0.71	9.14	0.99	5.12
	1300	0.47	5.82	0.65	5.95	0.64	5.57	0.84	5.82
	1900	0.28	5.12	0.51	8.53	0.51	9.14	0.65	8.53
26	0100	0.23	4.83	0.50	9.85	0.45	8.83	0.58	8.83
	0700	0.80	5.33	0.96	5.22	0.92	5.22	1.09	5.22
	1300	0.88	5.57	0.95	4.83	0.91	4.74	1.10	5.45
	1900	0.75	5.45	0.90	4.57	0.82	5.45	1.05	5.57
27	0100	0.66	5.22	0.77	4.83	0.74	4.83	0.92	5.02
	0700	0.57	4.66	0.81	4.66	0.67	4.57	0.81	4.34
	1300	0.72	4.57	0.71	4.20	0.64	3.94	0.75	4.20
	1900	0.52	4.20	0.64	5.12	0.61	9.14	0.71	8.53
28	0100	0.52	4.74	0.51	8.83	0.52	8.53	0.56	8.83
	0700	0.24	17.07	0.45	8.26	0.45	8.83	0.51	8.53
	1300	0.38	15.06	0.43	13.47	0.44	9.48	0.46	8.00
	1900	0.29	16.00	0.39	15.06	0.44	8.53	0.51	8.53
29	0100	0.38	16.00	0.42	16.00	0.43	8.53	0.51	8.53
	0700	0.25	8.26	0.36	8.53	0.43	8.53	0.44	8.26
	1300	0.29	8.26	0.34	8.00	0.37	8.26	0.41	8.83
	1900	0.24	8.00	0.29	8.00	0.36	8.00	0.42	8.26
30	0100	0.36	8.00	0.36	8.26	0.39	7.53	0.49	8.53
	0700	0.20	8.00	0.36	8.00	0.41	7.53	0.48	8.00
	1300	0.36	7.53	0.36	8.00	0.45	8.53	0.52	7.76
	1900	0.31	4.57	0.46	8.00	0.48	8.00	0.61	8.00
Mean		0.68	8.43	0.91	8.91	0.96	8.47	1.07	8.17
Std dev		0.42	3.92	0.67	3.24	0.79	2.99	0.81	2.85

* Electronic problems

(Sheet 2 of 2)

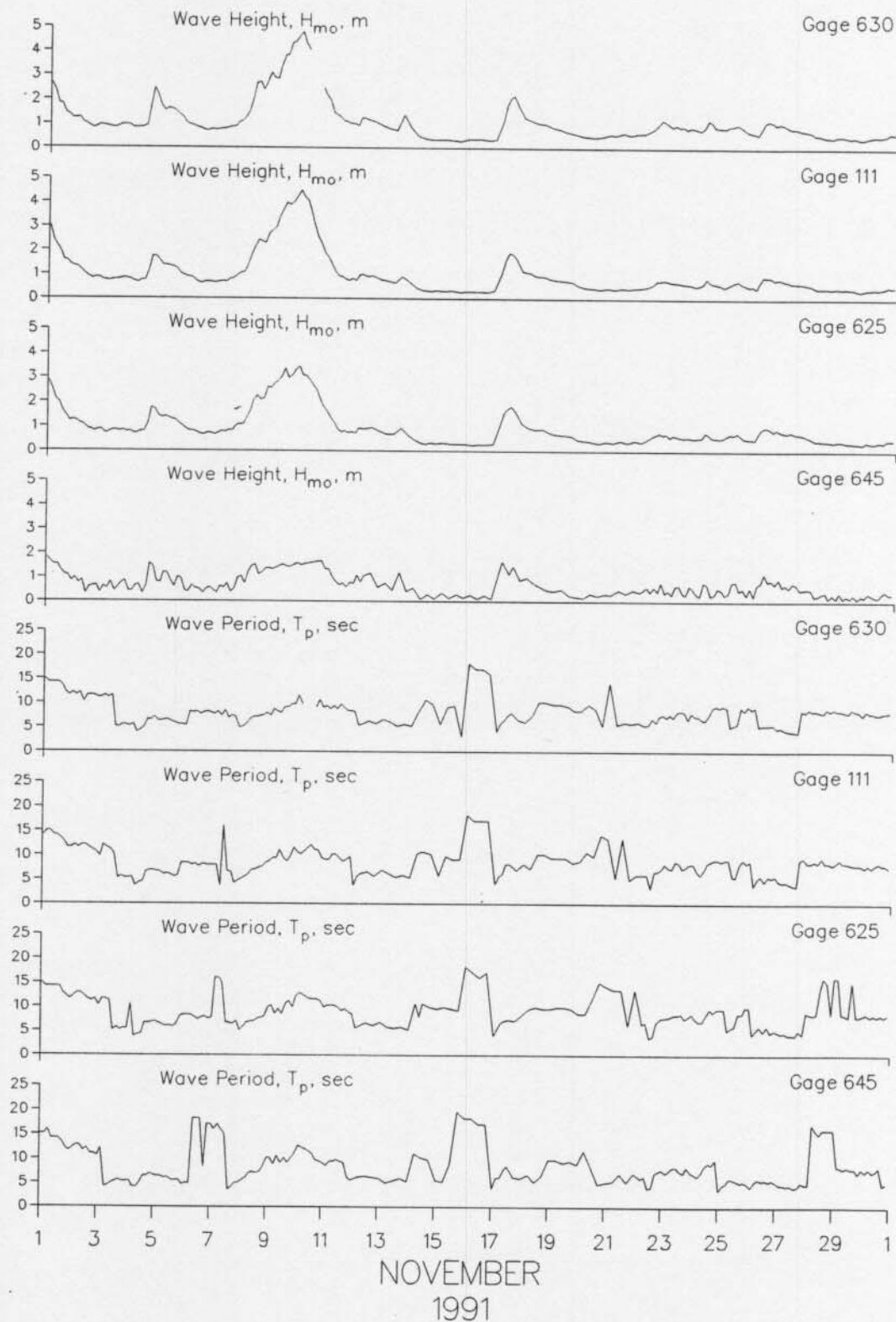


Figure 3. Time history of wave heights and periods

PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the data.

Table 4: Current Data
Nov 1991

Alongshore Cross-shore Resultant Time Day	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter	
	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	Speed
1 0100-Along Cross Result									28	S
									8	off
									29	144
1 0700-Along Cross Result	28 25 37	S off 118	189	30 9 32	S off 143	no observation			18 7 19	S off 139
1 1300-Along Cross Result									3 5 6	S off 101
1 1900-Along Cross Result									11 5 12	S off 136
2 0100-Along Cross Result									3 0 3	S off 160
2 0700-Along Cross Result	32 24 40	N off 17	239	14 16 21	N off 29	South	11	S	1 0 1	N off 340
2 1300-Along Cross Result									16 5 17	N on 323
2 1900-Along Cross Result									6 3 7	N on 313
3 0100-Along Cross Result									4 1 4	N on 326
3 0700-Along Cross Result	34 0 34	S off 160	201	29 0 29	S off 160	North	35	N	11 5 12	S off 136
3 1300-Along Cross Result									9 4 10	S off 136
3 1900-Along Cross Result									7 5 9	S off 124
4 0100-Along Cross Result									2 2 3	S off 115
4 0700-Along Cross Result	22 0 22	S off 160	177	20 4 21	S off 149	no observation			4 3 5	S off 123
4 1300-Along Cross Result									20 7 21	S off 141
4 1900-Along Cross Result									32 9 33	S off 144
5 0100-Along Cross Result									18 6 19	S off 142
5 0700-Along Cross Result	61 0 61	S off 160	188	87 17 89	S off 149	no observation			16 6 17	S off 139
5 1300-Along Cross Result									17 6 18	S off 141
5 1900-Along Cross Result									8 3 9	S off 139

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Nov 1991

Day	Time	Pier Measurements				Beach Measurements				Current Meter	
		Alongshore Cross-shore Resultant	Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Location	Speed	Dir	Depth -5.6m (NGVD)
6	0100-Along Cross Result									7	S
6	0700-Along Cross Result	18 4 18	S on 174	177	18 4 18	S off 149	North	13	N	3	off
6	1300-Along Cross Result									8	137
6	1900-Along Cross Result									6	S
7	0100-Along Cross Result									3	off
7	0700-Along Cross Result	16 0 16	S 0 160	201	10 0 10	S 160	no observation			4	133
7	1300-Along Cross Result									2	off
7	1900-Along Cross Result									4	S
8	0100-Along Cross Result									2	off
8	0700-Along Cross Result	61 0 61	S 0 160	201	203 0 203	S 160	no observation			5	S
8	1300-Along Cross Result									3	off
8	1900-Along Cross Result									6	129
9	0100-Along Cross Result									12	S
9	0700-Along Cross Result	122 37 127	S off 143	238	102 0 102	S 160	no observation			5	off
9	1300-Along Cross Result									13	137
9	1900-Along Cross Result									15	S
10	0100-Along Cross Result									5	off
10	0700-Along Cross Result	36 0 36	S 0 160	no observation		no observation				16	142
10	1300-Along Cross Result									16	S
10	1900-Along Cross Result									17	off
										30	S
										9	off
										31	143
										36	S
										10	off
										37	144
										50	S
										15	off
										52	143
										42	S
										16	off
										45	139
										72	S
										25	off
										76	141
										78	S
										31	off
										84	138
										61	S
										25	off
										66	138

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Nov 1991

Day	Time	Pier Measurements				Beach Measurements				Current Meter	
		Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed
11	0100-Along Cross Result										0.9 km Offshore
11	0700-Along Cross Result	17	S						12m offshore (surface)	(500m Updrift)	Depth -5.6m (NGVD)
11	1300-Along Cross Result	10	off		no observation						ID #519
11	20	129									
11	1900-Along Cross Result										14
11	0100-Along Cross Result										3
11	0700-Along Cross Result										14
11	1300-Along Cross Result										148
11	1900-Along Cross Result										10
12	0100-Along Cross Result										1
12	0700-Along Cross Result	15	S								off
12	1300-Along Cross Result	0									10
12	1900-Along Cross Result	15	160								154
13	0100-Along Cross Result										12
13	0700-Along Cross Result	28	S								3
13	1300-Along Cross Result	0									146
13	1900-Along Cross Result	28	160								12
14	0100-Along Cross Result										3
14	0700-Along Cross Result	6	S								off
14	1300-Along Cross Result	2	off								9
14	1900-Along Cross Result	6	143		0		0		no observation		139
15	0100-Along Cross Result										13
15	0700-Along Cross Result	24	N								143
15	1300-Along Cross Result	10	off		238		3				142
15	1900-Along Cross Result	26	2				9				133

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Nov 1991

Day	Time	Pier Measurements				Beach Measurements			Current Meter				
		Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	(500m Updrift)	Dye 12m offshore (surface)	Location	Speed	Dir
16	0100-Along Cross Result											2	N
												0	
												2	340
16	0700-Along Cross Result	10	N		229	5	N		South	6	S	2	N
		9	off			9	off					0	
		13	22			10	40					2	340
16	1300-Along Cross Result											8	N
												1	on
												8	333
16	1900-Along Cross Result											4	N
												0	
												4	340
17	0100-Along Cross Result											1	N
												1	off
												1	25
17	0700-Along Cross Result	55	S		219	47	S		North	68	N	23	S
		17	off			14	off					7	off
		58	143			49	143					24	143
17	1300-Along Cross Result												
17	1900-Along Cross Result											17	S
												7	off
												18	138
18	0100-Along Cross Result											19	S
												7	off
												20	140
18	0700-Along Cross Result	61	S		177	61	S		no observation			12	S
		6	off			9	off					4	off
		61	154			62	151					13	142
18	1300-Along Cross Result											10	S
												5	off
												11	133
18	1900-Along Cross Result											5	S
												3	off
												6	129
19	0100-Along Cross Result											2	S
												1	off
												2	133
19	0700-Along Cross Result	20	N		177	0			no observation			3	S
		6	off			10	off					2	off
		21	357			10	97					4	126
19	1300-Along Cross Result											5	N
												4	on
												6	301
19	1900-Along Cross Result											5	N
												2	on
												5	318
20	0100-Along Cross Result											15	N
												7	on
												17	315
20	0700-Along Cross Result	12	N		177	12	N		South	20	S	8	N
		9	off			0						6	on
		16	17			12	340					10	303
20	1300-Along Cross Result											11	N
												8	on
												14	304
20	1900-Along Cross Result											6	N
												5	on
												8	300

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N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Nov 1991

Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements				Current Meter		
	Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir
Day											
21 0100-Along Cross Result										0.9 km Offshore Depth -5.6m (NGVD) ID #519	
										15 7 17	N on 315
21 0700-Along Cross Result	19 11 22	N off 11		177	11 7 13	N off 11		South	26	S	10 7 12
21 1300-Along Cross Result											12 8 14
21 1900-Along Cross Result											8 5 9
22 0100-Along Cross Result											11 6 13
22 0700-Along Cross Result	41 4 41	N off 346		201	15 0 15	N off 340		no observation			17 5 18
22 1300-Along Cross Result											30 8 31
22 1900-Along Cross Result											14 7 16
23 0100-Along Cross Result											10 9 13
23 0700-Along Cross Result	0 10 10			198	0 6 6			South	30	S	11 7 13
23 1300-Along Cross Result											8 4 9
23 1900-Along Cross Result											7 5 9
24 0100-Along Cross Result											2 4 4
24 0700-Along Cross Result	11 10 15	N off 22		238	0 24 24			South	50	S	10 6 12
24 1300-Along Cross Result											5 7 9
24 1900-Along Cross Result											7 6 9
25 0100-Along Cross Result											18 5 19
25 0700-Along Cross Result	10 6 12	S off 129		189	15 6 16	S off 138		North	13	N	5 0 5
25 1300-Along Cross Result											5 4 6
25 1900-Along Cross Result											6 2 6

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Concluded)
Nov 1991

Day	Time	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter	
		Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519
26	0100-Along Cross Result									1 S
										0
										1 160
26	0700-Along Cross Result	23 S	140	68	S	45 N	North	4	N	
		0		0				3	on	
		23 160		68	160			5	303	
26	1300-Along Cross Result									6 S
										10 off
										12 101
26	1900-Along Cross Result									0
										1 on
										1 250
27	0100-Along Cross Result									9 S
										9 off
										13 115
27	0700-Along Cross Result	0	140	24	S	7 N	North	1	S	
		6 on		0				2	off	
		6 250		24	160			2	97	
27	1300-Along Cross Result									6 S
										10 off
										12 101
27	1900-Along Cross Result									8 S
										6 off
										10 123
28	0100-Along Cross Result									14 S
										15 off
										21 113
28	0700-Along Cross Result	20 S		no observation		no observation		10	S	
		0						8	off	
		20 160						13	121	
28	1300-Along Cross Result							17	S	
								9	off	
								19	132	
28	1900-Along Cross Result									7 S
										3 off
										8 137
29	0100-Along Cross Result									1 N
										3 on
										3 268
29	0700-Along Cross Result	30 N		14	N			14	N	
		3 off		0				3	on	
		31 346	137	14	340	no observation		14	328	
29	1300-Along Cross Result									12 N
										3 on
										12 326
29	1900-Along Cross Result									9 N
										5 on
										10 311
30	0100-Along Cross Result									6 N
										4 on
										7 306
30	0700-Along Cross Result	17 N		14	N	30 S	South	4	S	
		11 off		6	off			0		
		21 13	165	15	2			4	160	
30	1300-Along Cross Result									5 N
										4 on
										6 301
30	1900-Along Cross Result									4 N
										4 on
										6 295

KEY = All speeds in cm/sec

N = Northward, Shore parallel

S = Southward, Shore parallel

on = onshore off = offshore

PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves) are taken daily at the seaward end of the pier. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests at approximately the same location as the visual measurements. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are also taken daily at the seaward end of the pier. A jar along with a thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The jar is removed, the temperature read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the surface visibility.

Table 5: Supplemental Observations

Nov 1991

Day	Time	Wave Approach Angle at Pier End deg from True N		Radar Wave Angle deg from True N	Width of Surf Zone,m	Water Characteristics at Pier End		
		Primary	Secondary			Temp.,C	Density g/cc	Secchi Vis.,m
1	0930	70	5	70	195	16.7		0.9
2	0930	85	140		187	17.8		1.5
3	0938	15		90	171	16.5		1.2
4	0845	70	5		146	16.7		1.8
5	0845	35	5	60	171	15.0		1.2
6	0858	75	40	75	146	14.1		1.5
7	0857	100	10	75	183	14.1		1.5
8	0920	40	5	50	232	14.2	1.0215	0.9
9	0900	55		40	799	14.4	1.0222	0.3
10	1200	50	10	50	256	13.5		0.3
11	1055	120	90	90	171	13.0	1.0246	0.6
12	1049	20		50	171	13.1		0.9
13	0925	25			207	12.8	1.0242	0.9
14	0900	5				12.2	1.0228	1.2
15	0930	55	150			12.8	1.0226	1.8
16	0920	80			6	14.4	1.0248	0.9
17	0910	40		50	250	13.3	1.0250	0.6
18	0940	70	5	50	171	12.4	1.0223	1.8
19	0920	120			146	12.5	1.0209	1.5
20	0941	120			134	13.5	1.0240	1.2
21	0935	130			195	13.9	1.0242	0.6
22	0945	135			132	14.3	1.0244	0.6
23	0844	130	90		181	14.4	1.0248	0.9
24	0915	95	120	95	240	14.4	1.0244	1.2
25	1115	50	5		85	13.3	1.0250	0.9
26	0845	10	45		31	13.2	1.0248	0.9
27	0935	40	65		20	13.2	1.0248	2.4
28	0607	25	100		8	12.2	1.0238	1.8
29	1120	125	95		6	12.8	1.0231	2.1
30	0858	90			9	13.3	1.0242	1.8

PART VI: WATER LEVELS

Since 1978, the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service (NOS) has operated a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect instantaneous water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 4 along with a list of mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level.

Table 6 contains the time at the center of each 12.42-hr tidal cycle and the range, high, low, and mean water levels during each tidal cycle.

FRF Tide Heights

Nov 1991

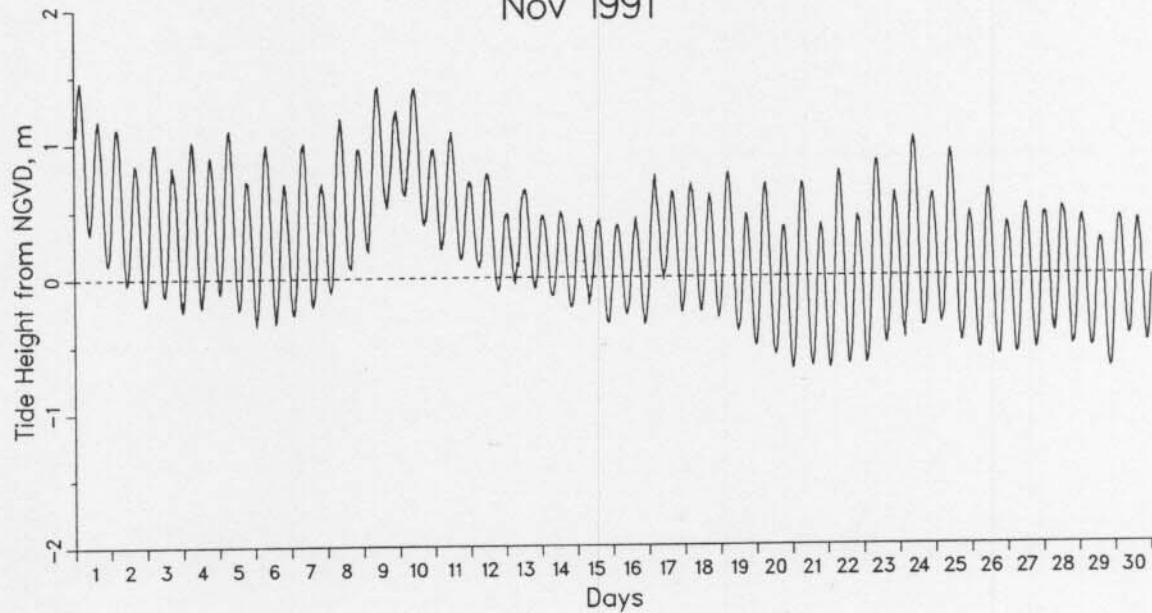


Figure 4. Water level time history

Monthly Water Levels, m NGVD

Extreme Low = -0.69 on day 29 at 1954 EST
Extreme High = 1.47 on day 1 at 254 EST
Monthly Mean = 0.24
Mean Low = -0.25
Mean High = 0.75
Mean Range = 1.01

Table 6: Water Levels.m NGVD

		Nov 1991			
Mid-Cycle Day	Time	Low	High	Mean	Range
1	606	0.34	1.47	0.89	1.13
1	1831	0.10	1.18	0.63	1.08
2	656	-0.04	1.11	0.54	1.15
2	1921	-0.20	0.85	0.33	1.05
3	746	-0.13	1.00	0.43	1.13
3	2012	-0.24	0.83	0.30	1.08
4	837	-0.21	1.02	0.39	1.23
4	2102	-0.11	0.91	0.39	1.02
5	927	-0.24	1.10	0.42	1.34
5	2152	-0.35	0.72	0.22	1.07
6	1018	-0.34	0.99	0.33	1.33
6	2243	-0.27	0.70	0.22	0.97
7	1108	-0.21	1.00	0.38	1.22
7	2333	-0.11	0.77	0.34	0.89
8	1158	0.07	1.19	0.60	1.12
9	24	0.20	1.09	0.63	0.89
9	1249	0.52	1.42	0.94	0.90
10	114	0.61	1.24	0.93	0.64
10	1339	0.39	1.41	0.86	1.02
11	204	0.21	0.96	0.60	0.75
11	1430	0.14	1.08	0.56	0.94
12	255	0.07	0.71	0.40	0.64
12	1520	-0.10	0.77	0.30	0.87
13	345	-0.05	0.56	0.25	0.61
13	1610	-0.08	0.65	0.28	0.73
14	436	-0.13	0.46	0.16	0.59
14	1701	-0.22	0.49	0.12	0.71
15	526	-0.20	0.43	0.13	0.63
15	1751	-0.34	0.43	0.04	0.77
16	616	-0.28	0.39	0.06	0.67
16	1841	-0.35	0.44	0.05	0.79
17	707	-0.03	0.76	0.34	0.78
17	1932	-0.27	0.63	0.19	0.90
18	757	-0.26	0.69	0.21	0.94
18	2022	-0.30	0.61	0.16	0.91
19	847	-0.40	0.77	0.15	1.17
19	2113	-0.51	0.47	-0.01	0.97
20	938	-0.58	0.69	0.02	1.26
20	2203	-0.68	0.38	-0.12	1.07
21	1028	-0.67	0.69	-0.01	1.36
21	2253	-0.68	0.50	-0.10	1.18
22	1119	-0.65	0.78	0.03	1.43
22	2344	-0.65	0.56	-0.05	1.21
23	1209	-0.50	0.86	0.16	1.35
24	34	-0.46	0.72	0.14	1.19
24	1259	-0.37	1.03	0.28	1.40
25	125	-0.35	0.70	0.16	1.05
25	1350	-0.48	0.93	0.16	1.42
26	215	-0.54	0.48	-0.02	1.01
26	1440	-0.59	0.64	-0.01	1.23
27	305	-0.58	0.39	-0.07	0.97
27	1531	-0.55	0.52	-0.01	1.07
28	356	-0.42	0.46	0.04	0.88
28	1621	-0.52	0.51	0.00	1.02
29	446	-0.53	0.44	-0.05	0.97
29	1711	-0.69	0.27	-0.19	0.96
30	537	-0.45	0.43	0.00	0.88
30	1802	-0.50	0.41	-0.04	0.91

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Geodimeter surveying system; a Geodimeter 140-T self tracking electronic theodolite, distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in October and the two surveys done in November on profile line 188, located 517 m south of the pier. Both November surveys were taken following notable storms. The survey on 3 November followed the October "Halloween" storm and shows a 40 m seaward shift in the nearshore (180 - 350 m) bar. Offshore (520 - 780 m) there is a significant amount (0.25 m) of erosion while a prominent berm (120 m) was removed from the beach face. The second survey on 12 November which also followed a strong storm shows a continuing 35 m seaward shift in the nearshore bar with no recovery to the offshore portion of the profile. The beach face also shows further erosion.

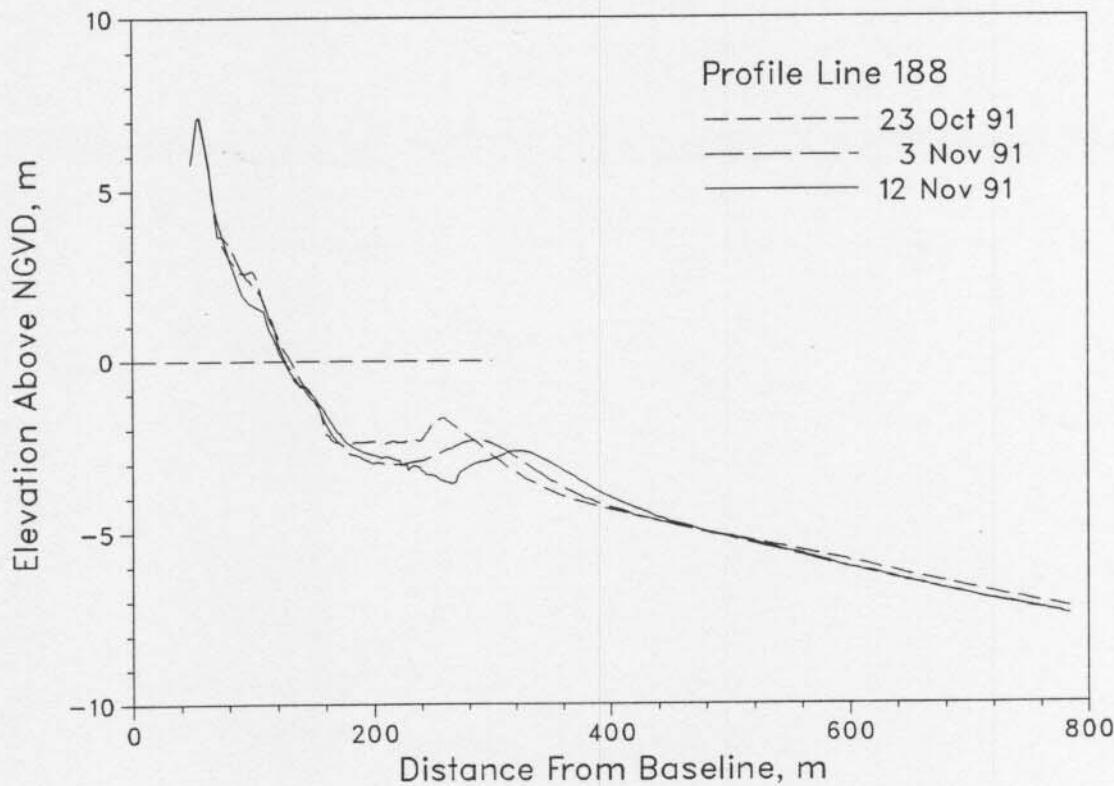


Figure 5. Monthly CRAB profiles on profile 188 -
517 m south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1991. The changes to the seaward portion of the envelope (500 - 780 m) were caused by the Halloween storm while the changes closer to shore (250 m and 360 m) were from the 8 - 10 November storm.

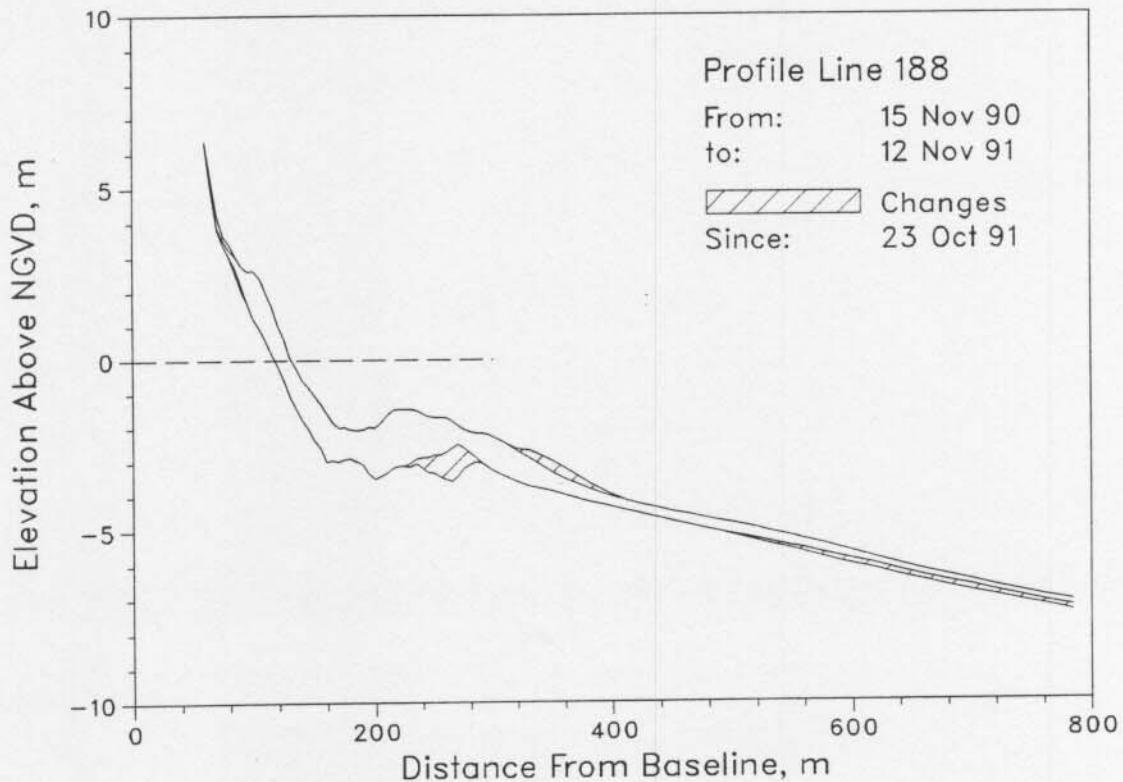


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey on 12 November. Wide contour lines on the change diagram represent eroded areas; thin lines indicate deposition.

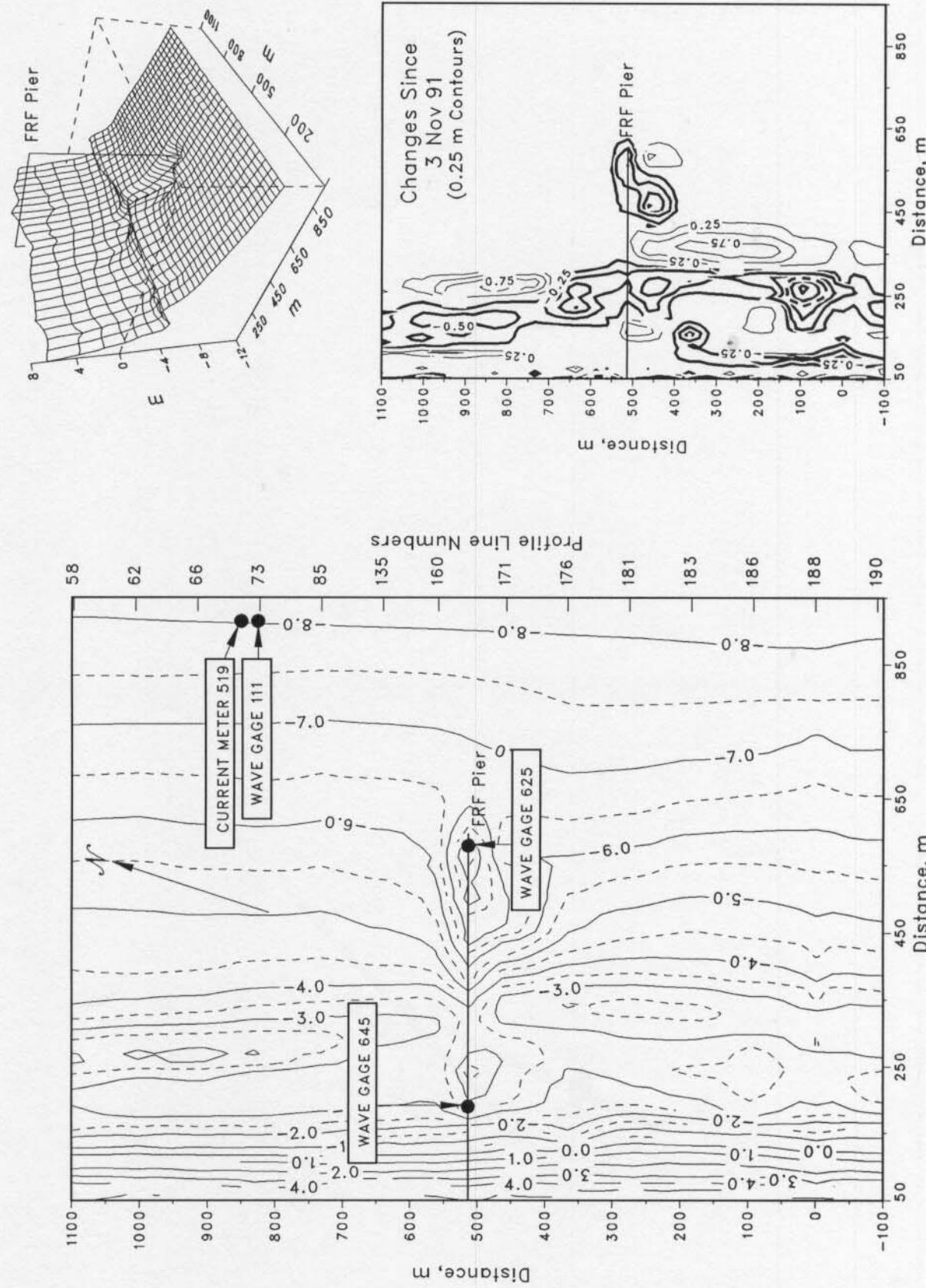


Figure 7. FRF bathymetry 12 Nov 91 depths relative to NGVD

PART VIII. SPECIAL EVENTS

A. Storm Data Collection. The following list identifies times when the significant wave height at the seaward end of the pier (i.e. as measured near the end of the pier) exceeded 2 m and four contiguous 34 minute wave records were obtained every three hours:

<u>Start</u>	<u>End</u>
1 Nov (0100)	1 Nov (0842)
8 Nov (0616)	10 Nov (1708)

B. Storm Synopsis.

1 November - This was the end of the "Halloween" storm which continued from 28 October through 1 November. The storm is described in depth in the October 1991 Preliminary Data Summary.

8 - 10 November - Developing off Florida on 7 November this storm slowly moved up the coast being located near Cape Hatteras, NC early on 10 November and reaching New England by 12 November. Maximum wind speeds (from northeast) exceeded 21 m/s at 1600 EST on 9 November followed by the peak H_{mo} (at gage 625) which reached 3.49 m ($T_p = 12.19$ sec) at 2234 EST. The minimum atmospheric pressure of 1003.3 mb was recorded at 0508 EST on 10 November. Total precipitation was 39 mm.

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